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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/512,016	06/27/2005	Hans-Joachim Barth	10808/163	8447

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EXAMINER

VELASQUEZ, VANESSA T

ART UNIT	PAPER NUMBER
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4116

MAIL DATE	DELIVERY MODE
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01/08/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/512,016

Applicant(s)

BARTH ET AL.

Examiner

VANESSA T. VELASQUEZ

Art Unit

4116

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 June 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 June 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-8500)
Paper No(s)/Mail Date Oct. 19, 2004 and Jan. 26, 2007
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Inventor's Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Status of Application

Claims 12-22 are pending and are presented for examination on the merits.

Priority

1. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy, filed on October 19, 2004, has been placed of record in the file.

Information Disclosure Statement

Two (2) information disclosure statements (IDS) were submitted on October 19, 2004 and January 26, 2007. The IDS submitted on January 26, 2007 is in compliance with the provisions of 37 CFR 1.97. Accordingly, it is being considered by the examiner.

Regarding the IDS submitted October 19, 2004, applicant is reminded that it is improper to cite an International Search Report (ISR) of a PCT application as a reference; however, in the instant case, all references cited in the ISR were considered because they were also cited separately in the IDS.

Claim Objections

2. Claim 13 is objected to because of a typographical error. The term "feature sizes" is misspelled. Appropriate correction is required.

3. Claim 18 is objected to because there are no units specifying the proportion of impurity. The Examiner will assume the percentage to be percent by weight.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 12, 15, 16, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schwuttke et al. (US 3,585,088).

Regarding claim 12, Schwuttke et al. teach a method of recrystallizing polycrystalline materials in order to decrease electromigration and improve conductivity in integrated circuit devices (US '088, Col. 3, Lines 39-48). Figure 1 of Schwuttke et al. shows a substrate (Part 12) on which metal or semiconductor material (Part 10) is

Art Unit: 4116

deposited (US '088, Col. 3, Lines 28-36). The deposited material is subsequently irradiated with a laser beam to induce recrystallization and grain enlargement (US '088, Col. 4, Lines 58-66).

Schwuttke et al. do not explicitly teach the motion of sweeping the laser beam across the deposited metal material to produce a moving thermal region; however, this type of movement would clearly be an obvious maneuver by one of ordinary skill in the art desiring to recrystallize the entire metal area. For instance, an aluminum test stripe 0.5 inch by 0.025 inch (US '088, Example I, Col. 5, Lines 63-69) was exposed to a laser beam capable of irradiating a circular area having a radius of 50 microns (US '088, Example III, Col. 6, Lines 34-41). The laser beam covers an area smaller than the stripe; thus, in order to recrystallize the entire area, the laser would have to be scanned over the entire area. One would be motivated to recrystallize the entire area because larger grains enhance the performance of electronic devices (US '088, Col. 3, Lines 39-48).

Regarding claim 15, in Example IV of US '088, amorphous silicon is irradiated repeatedly to form an ordered structure (US '088, Example IV, Col. 6, Lines 65-67). Although the material is not metal, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the same repetitive irradiation to a metal surface because one would expect to achieve similar results of obtaining a particular grain structure.

Regarding claim 16, grain enlargement is induced via laser energy (US '088, Col. 4, Lines 23-25).

Regarding claim 17, Figure 3 (US '088) illustrates a circular region of enlarged grains formed by localized irradiation.

7. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schwuttke et al. (US 3,585,088) in view of Yabe (US 5,405,804).

Schwuttke et al. teach recrystallizing metal to enlarge grain size but fail to teach patterning the metal into particular geometries. Yabe teaches methods of manufacturing semiconductor devices, one of which is a CMOS inverter in which the aluminum metal wiring is T-shaped (US '804, see FIG. 6A, Part 15; Col. 5, Lines 50-54). The T-shaped electrode consists of two line segments orthogonal to one another. It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the recrystallization method of Shwuttke et al. to the inverter of Yabe because the larger grains produced as a result of recrystallization could enhance the electrical performance of the semiconductor devices produced by Yabe.

See the 35 USC 103(a) rejection of claim 12 regarding movement of the thermal region. Furthermore, there are a limited number of angles and directions in which one can move the beam, either manually or automatically, over the desired area. One of ordinary skill in the art would still expect grain enlargement regardless of the direction chosen.

8. Claims 13 and 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schwuttke et al. (US 3,585,088) in view of Shimizu et al. (US 6,242,808 B1).

Regarding claim 13, Schwuttke et al. fail to teach aluminum with feature sizes less than 0.2 micron. Shimizu et al. teach a doped copper layer 50 nm thick (US '808, Col. 4, Lines 24-25). Because there is a growing trend toward miniaturization of circuit elements to make devices more compact and lightweight, one of ordinary skill in the art would be motivated to apply the process by Schwuttke et al. to the fabrication methods of Shimizu et al. to make smaller electrodes with increased resistance to electromigration.

Regarding claim 18, the copper layer is doped with tin impurity 0.5 by weight (US '808 Col. 4, Line 25).

Regarding claim 19, a barrier layer of TiN lies between the insulation layer and the seed layer (US '808, Col. 4, Lines 13-17).

Regarding claim 20, the damascene method is well-known to one ordinary skill in the art (US '808, Col. 1, Lines 54-65).

Regarding claims 21 and 22, the copper layers are subjected to heat treatment at 400°C under an inert argon and passivating hydrogen atmosphere (US '808, Col. 4, Lines 38-40).

Conclusion

No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to VANESSA T. VELASQUEZ whose telephone number is

Art Unit: 4116

(571)270-3587. The examiner can normally be reached on Monday-Friday 7:30 AM-5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Vanessa T Velasquez/
Examiner, Art Unit 4116

/Vickie Kim/

Supervisory Patent Examiner, Art Unit 4116